FIELD CROPS SOUTH

FUNGICIDE BENEFITS ASSESSMENT

National Agricultural Pesticide Impact Assessment Program (NAPIAP)

FUNGICIDE BENEFITS ASSESSMENT

FIELD CROPS - SOUTH

January, 1991

Thomas Kucharek

Department of Plant Pathology
University of Florida

This Report Represents a Portion of the USDA/States
National Agricultural Pesticide Impact Assessment Program (NAPIAP)
Fungicide Assessment Project

TABLE OF CONTENTS

PREFACE

Plant diseases affect all the major food crops world-wide and must be controlled to prevent significant production losses and maintain food quality for animals and humans. In addition, fungicides are a necessary factor in maintaining the availability of fiber and landscape improvements ranging from forest management to enhancements through the use of ornamentals. Agricultural fungicides are a significant component in effective disease control and are critical to plant health management systems. Fungicides provide benefits to producers as well as consumers and to local as well as national economies. Farmers benefit from the prevention of yield losses, improved crop quality, enhanced market opportunities, facilitation of farmwork and harvest. Consumers also benefit from an ample, varied, safe, healthy and inexpensive food supply that is available throughout the year.

This is one of 11 separate reports that assessed the beneficial aspects of fungicide use in U.S. agriculture. The 11 reports, all using a commodity approach in evaluating fungicide use, comprise the Fungicide Benefits Assessment. This assessment represents one part of the USDA/States National Agricultural Pesticide Impact Assessment Program's Fungicide Assessment Project. The two other parts deal with (a.) a treatise examining the health and environmental factors associated with the agricultural use of fungicides, and (b.) an assessment of the status as well as the management strategies for fungal resistance to fungicides in the U.S.

The 11 Fungicide Benefits Assessment reports were prepared by a team of scientists (team leaders). The team leaders and the listing of their reports (by commodity) in the Fungicide Benefits Assessment are as follows:

Team Leader	Commodity
John Ayers Department of Plant Pathology 211 Buckhout Laboratory The Pennsylvania State University University Park, PA 16802	**Turf**
Gary Bergstrom Department of Plant Pathology 317 Plant Science Building Cornell University Ithaca, NY 14853	**Field Crops - North**
Michael Davis Department of Plant Pathology University of California Davis, CA 95616	**Vegetables - West**

Douglas Gubler.....Fruits & Nuts - West
Department of Plant Pathology
University of California
Davis, CA 95616

Kenneth Hickey.....Fruits & Nuts - East
Fruit Research Lab
Box 309
290 University Drive
The Pennsylvania State University
Biglerville, PA 17307

Stephen Johnston.....Vegetables - East
Rutgers Research Development Center
RD 5, Box 232
Northville Road
Rutgers University
Bridgeton, NJ 08302

Narcy Klag.....Regulatory
USDA/APHIS
6505 Belcrest Rd.
Room 632
Hyattsville, MD 20782

Charles Krause.....Ornamentals
Department of Plant Pathology
The Ohio State University
Selby Hall
OARDC
Wooster, OH 44691

Thomas Kucharek.....Field Crops - South
Department of Plant Pathology
University of Florida
1453 Fifield Hall
Gainesville, FL 32611

Gregory Shaner.....Cereals
Department of Botany and Plant Pathology
Lilly Hall
Purdue University
W. Lafayette, IN 47907

Paul Wuest.....Mushrooms
Department of Plant Pathology
The Pennsylvania State University
211 Buckhout Lab
University Park, PA 16802

Appreciation is extended to members of the Planning Committee and many other collaborators who gave generously of their time and expertise in helping develop the project, reviewing report drafts, providing information and preparation of the various reports.

PLANNING COMMITTEE AND COLLABORATORS

Gary Ballard, EPA
Joseph Barse, ERS/USDA
Herbert Cole,Jr., The Pennsylvania State University
Stephen Connor, Rohm and Haas
Charles R. Curtis, The Ohio State University
Ronald Davis, ARS/USDA
Richard Dumas, EPA
Zdenka Horakova, FS/USDA
Barry Jacobsen, Auburn University
Paul Lewis, EPA
Craig Osteen, ERS/USDA
James Parochetti, CSRS/USDA
Neal Pelletier/EPA
Charles C. Powell,Jr., The Ohio State University
Nancy N. Ragsdale, University of Maryland
Robert Riley, CSRS/USDA
Patricia L. Sanders, The Pennsylvania State University
Charles L. Smith, Pesticide Coordinator/USDA
Robert Torla,EPA

Catherine Reinoehl and Ramona I. Powell of The Ohio State University are gratefully acknowledged for their assistance during the project or in manuscript preparation.

This project was partially supported by funds provided by the Extension Service and the Cooperative State Research Service (CSRS), USDA though a cooperative agreement between The Ohio State University and CSRS.

Cover design by University Publications, The Ohio State University. Printing by The Ohio State University Printing Facility, Columbus, Ohio.

Charles R. Curtis, Project Director
Nancy N. Ragsdale, Coordinator Representing the USDA

January, 1991

Contributors To Fungicide Benefits Analysis for
Cotton, Peanuts, Soybeans, Sugar Beets, Sugarcane and Tobacco

STATES	COMMITTEE MEMBERS (CONTRIBUTORS)
ALABAMA	WILLIAM GAZAWAY, AUSTIN HAGAN
ARKANSAS	MADISON McDANIEL, TERRY KIRKPATRICK
CALIFORNIA	STEVE TEMPLE, JIM DEVAY
COLORADO	EARL RUPPEL
CONNECTICUT	JIM LAMONDIA
DELAWARE	ROBERT MULROONEY
FLORIDA	TOM KUCHAREK, RICHARD RAID, TONY PEACOCK
GEORGIA	SAM THOMPSON, PAUL BERTRAND, WILLIAM POWELL, JOHNNY CRAWFORD
HAWAII	STEPHEN FERREIRA
IDAHO	ROBERT FORSTER
ILLINOIS	WALKER KIRBY
INDIANA	DON SCOTT
IOWA	LAURA SWEETS
KANSAS	DOUGLAS JARDINE
KENTUCKY	WILLIAM NESMITH, RICHARD STUCKEY
LOUISIANA	KEN WHITAM, LOWELL BLACK
MARYLAND	ARVYDAS GRYBAUSKAS
MASSACHUSETTS	JIM LAMONDIA
MICHIGAN	JOHN HALLOIN, L. PATRICK HART
MINNESOTA	ROGER JONES
MISSISSIPPI	FRANK KILLEBREW, DONALD BLASINGAME, BILLY MOORE
MISSOURI	ALLAN WRATHER, EINAR PALM
MONTANA	JACK RIESSELMAN
NEBRASKA	ERIC KERR, DAVID WYSON
NEW JERSEY	JACK SPRINGER
NEW MEXICO	EMROY SHANNON
NEW YORK	GARY BERGSTROM
NORTH CAROLINA	JACK BAILEY, PAUL SHOEMAKER, TOM MELTON, DONALD SCHMITT
NORTH DAKOTA	H. ARTHUR LAMEY, WILLIAM BUGBEE
OHIO	LEONARD HERR, IRA DEEP
OKLAHOMA	KEN JACKSON
OREGON	PAUL KOEPSELL
PENNSYLVANIA	JOHN AYERS, MR. ROBERT ANDERSON
SOUTH CAROLINA	CHARLES DRYE, BRUCE MARTIN
TENNESSEE	DON FOWLKES, MELVIN NEWMAN
TEXAS	THOMAS LEE, HAROLD KAUFMAN, CHARLES RUSH, JOSE AMADOR, JOE KRAUSZ
VIRGINIA	PATRICK PHIPPS, CHARLES JOHNSON
WEST VIRGINIA	CHARLES SPEROW
WISCONSIN	ROBERT NEWMAN, CRAIG GRAU
WYOMING	PAUL VINCELLI

NAPIAP REPORT ON BENEFITS FROM FUNGICIDE USE IN THE UNITED STATES FOR COTTON, PEANUTS, SOYBEANS, SUGAR BEETS, SUGARCANE AND TOBACCO

TOM KUCHAREK

This report presents data gathered from Extension Plant Pathologists and others in the United States. The data is presented in tables based upon the questions asked for in the Assessment Of The Agricultural Benefits Of Fungicide Use In The United States--A Plan. The data is from surveys conducted by mail and follow-up phone calls. These data are estimates and based upon professional opinion which is the method agreed upon by members of the committee, members of the Environmental Protection Agency, and members of the Economic Research Service.

The team leader had to make judgmental decisions in some situations because of the lack of information or because of natural interpretive situations. However, specific data were obtained for all the pertinent crops in nearly all of the pertinent states.

The data in this report indicate strongly the continued need for the fungicides in question, (captan, benomyl, maneb, mancozeb, and chlorothalonil). They are needed to protect the nation's food supply from the ravages of pestilence. There are no known adverse effects from these chemicals to humans. Curtailment of their use, past, present or future, jeopardizes the volume and quality of our food supply. Chemicals are expensive and for that reason, growers use them on an as-needed basis in any given year. That growers use discretion when using chemicals is evident in minimal use of fungicides on some crops nationwide and by the reduced usage of chemicals in situations where diseases are less likely to cause damage.

Currently, the voluntary withdrawal of mancozeb from cotton (for Arizona, New Mexico and Texas) and tobacco have placed those crops in jeopardy in some years. The losses we have incurred for labelling of the EBDC's in the past several years for agronomic and vegetable crops has caused us to be without controls for some diseases on some crops.

Because the EBDC losses are the result of scare tactics that relate to opinion rather than sound scientific data, the public has lost its faith in government opinion. Commercial companies are no longer willing to maintain strong agricultural divisions for future research and development. The basis for commercial involvement in agricultural chemicals has become dependant upon political opinion; therefore, companies are reducing or eliminating agricultural divisions so that adverse opinion will not destroy the larger divisions of those corporations. The agricultural community of this country needs some positive action to make it a desirable source of employment. The negative forces that predominate today in political circles against agricultural chemicals are embedded in purposely contrived sensationalism. We are placing at risk our food producing ability in this country if we continue to allow unfounded opinion to dictate crop production methods.

COTTON SUMMARY

Cotton seedlings are susceptible to several fungal pathogens. Rhizoctonia spp. and Pythium spp. are the most common pathogens of cotton seedlings. Nearly all cotton seed is treated with a combination of seed treatment fungicides prior to planting. Bècause of the array of fungal pathogens that infect cotton seedlings, seed treatment is required. Most seed treatments are applied by the seed handler. A combination of fungicides is used because the various fungicides each have a spectrum of activity that is somewhat limited in efficacy to the respective fungi. For example, carboxin is used for control of Rhizoctonia spp. and metalaxyl is used for control of Pythium spp. Captan is used primarily for control of Rhizoctonia but because of its somewhat broadspectrum activity, it provides control of other fungi also.

In-furrow treatments with fungicides are also used. Considerable variation exists between states in the use of in-furrow treatments. For example, California does not use in-furrow treatments, but the mid-south states of Missouri, Tennessee, Arkansas and Alabama rely on in-furrow treatments. The mid-south states tend to have cotton planted in cooler soils which probably explains the reliance on in-furrow treatments.

Cultural controls such as planting in warm soil, planting shallow, and thorough green manure decomposition by adequate tillage prior to planting provide some control of fungal seedling blights. However, cultural controls, by themselves, are not adequate controls for this complex disease. Cultural controls plus chemicals provide a useable system and integrated approach for seedling blight control throughout the United States. Seedling blights have commonly caused near total stand losses. Replanting is then required which increases production costs.

On occasion, in the southwest United States, cotton rust can cause yield reduction. This rust is favored by high humidities and thus it does not occur in most years. This rust is limited to Texas, New Mexico, Arizona and Mexico where the alternate host, gamma grass, abounds. Less than 1% of the cotton acreage is treated with mancozeb for control of rust with aerial application. In some years none of the acreage of cotton in the United States is sprayed with mancozeb. Resistant varieties can be used to some extent. However, chemical control is relied upon. Multiple sprays must be applied beginning prior to infection. If cotton rust is not controlled, yield losses of over 50% can occur.

The voluntary withdrawal of mancozeb for labelling on cotton was not necessary. The small amount of acreage sprayed, the inability of the non-systemic spray to reach the seed and linters, which are used for food products, and the low oncogenic risk of 6.4×10^{-8} for mancozeb on cotton suggest that the removal of mancozeb for use on cotton is not a sensible decision.

ACREAGE OF COTTON IN THE U.S.

STATE	COTTON
ALABAMA	340,000
ARIZONA	550,000
ARKANSAS	700,000
CALIFORNIA	1,500,000
FLORIDA	28,000
GEORGIA	300,000
KANSAS	1,000
LOUISIANA	550,000
MISSISSIPPI	1,000,000
MISSOURI	225,000
NEW MEXICO	90,000
NORTH CAROLINA	110,000
OKLAHOMA	80,000
SOUTH CAROLINA	140,000
TENNESSEE	400,000
TEXAS	5,600,000
VIRGINIA	29,000

NON-FUNGICIDE MANAGEMENT TECHNIQUES FOR CONTROL OF DISEASES IN COTTON

MANAGEMENT TECHNIQUE
CROP ROTATION
PROPER SOIL TILLAGE PRIOR TO PLANTING
MINIMIZE PLANT STRESS
NEMATODE CONTROL
PROPER PLANTING DEPTH
PROPER PLANTING DATE
RESISTANT VARIETIES
PROPER PLANT SPACING IN THE ROW
INSECT CONTROL
PROPER USE OF NITROGEN FERTILIZER
KNOWLEDGE OF VARIETY GROWTH HABIT
MONITOR RAINFALL
PLANT IN WARM SOIL

SEED & IN-FURROW TREATMENTS FOR SEEDLING BLIGHT CONTROL IN COTTON

STATE	CHEMICAL USED
ALABAMA	CARBOXIN, PCNB, THIRAM, CAPTAN, METALAXYL
ARIZONA	METALAXYL, CARBOXIN, CAPTAN, PCNB, ETHAZOL
ARKANSAS	CARBOXIN, THIRAM, CAPTAN, METALAXYL, PCNB, ETHAZOL
CALIFORNIA	METALAXYL, CHLORONEB, CARBOXIN, PCNB, CAPTAN
FLORIDA	CARBOXIN, METALAXYL, CHLORONEB, CAPTAN, PCNB, ETHAZOL
GEORGIA	PCNB, METALAXYL, CARBOXIN, CHLORONEB, CAPTAN
KANSAS	NONE
LOUISIANA	PCNB, ETHAZOL, METALAXYL
MISSISSIPPI	CARBOXIN, CAPTAN, METALAXYL, CHLORONEB-SMALL AMT. PCNB
MISSOURI	CAPTAN, CARBOXIN, THIRAM, METALAXYL, PCNB, ETHAZOL, DAGGER
NEW MEXICO	CHLORONEB, CARBOXIN, CAPTAN
NORTH CAROLINA	PCNB, ETHAZOL, CARBOXIN, CHLORONEB, THIRAM, CAPTAN, MANEB, MANCOZEB, FENAMINOSULF, BASIC COPPER SULFATE
OKLAHOMA	CAPTAN, METALAXYL, PCNB, ETHAZOL
SOUTH CAROLINA	METALAXYL, PCNB, CARBOXIN
TENNESSEE	CARBOXIN, CAPTAN, METALAXYL, THIRAM, PCNB, ETHAZOL
TEXAS	CAPTAN, CHLORONEB
VIRGINIA	CARBOXIN, PCNB, METALAXYL, CHLORPYRIFOS

FOLIAR FUNGICIDES USED ON COTTON

STATE	CHEMICAL USED
ALABAMA	NONE
ARIZONA	MANCOZEB
ARKANSAS	NONE
CALIFORNIA	NONE
FLORIDA	NONE
GEORGIA	NONE
KANSAS	NONE
LOUISIANA	NONE
MISSISSIPPI	NONE
MISSOURI	NONE
NEW MEXICO	MANCOZEB
NORTH CAROLINA	NONE
OKLAHOMA	NONE
SOUTH CAROLINA	NONE
TENNESSEE	NONE
TEXAS	MANCOZEB
VIRGINIA	NONE

NUMBER OF FUNGICIDE APPLICATIONS FOR COTTON BASED UPON USE PATTERNS

STATE	SEED	FURROW	FOLIAR
ALABAMA	1	0-1	0
ARIZONA	0-1	0-1	0-3
ARKANSAS	1	0-1	0
CALIFORNIA	1	0	0
FLORIDA	1	0-1	0
GEORGIA	1	0-1	1
KANSAS	0	0	0
LOUISIANA	1	0-1	0
MISSISSIPPI	1	0-1	0
MISSOURI	0-1	0-1	0
NEW MEXICO	1	0	0-3
NORTH CAROLINA	1	0-1	0
OKLAHOMA	1	0-1	0
SOUTH CAROLINA	1	0-1	0
TENNESSEE	0-1	0-1	0
TEXAS	1	0	0-1
VIRGINIA	1	0	0

PERCENT OF COTTON ACREAGE RECEIVING SEED & FOLIAR FUNGICIDE TREATMENTS

STATE	% SEED TREATMENT	% FOLIAR TREATMENT
ALABAMA	100%, IN FURROW 60%	0%
ARIZONA	95%, 35% IN FURROW	SMALL AMOUNTS FOR RUST
ARKANSAS	99.9%, IN FURROW & HOPPER BOX = 70%	0%
CALIFORNIA	100%	0%
FLORIDA	100%, IN FURROW 15%	0%
GEORGIA	100%, <15% IN FURROW	0%
KANSAS	0%	0%
LOUISIANA	100% (SOME IN FURROW TREATMENT)	0%
MISSISSIPPI	100% (20% IN FURROW TREATMENT)	0%
MISSOURI	95%, 50% IN FURROW	0%
NEW MEXICO	100%	1000 ACRES OUT OF 90,000
NORTH CAROLINA	100% (15% IN FURROW TREATMENT)	0%
OKLAHOMA	100% (SOME IN FURROW TREATMENT)	0%
SOUTH CAROLINA	100% (5-10% IN FURROW TREATMENT)	0%
TENNESSEE	95%, 45% USE IN FURROW TREATMENT	0%
TEXAS	100%	<5% ONLY EVERY 2-3 YEARS WHEN RUST OCCURS
VIRGINIA	100%	0%

FUNGICIDE RATES/APPLICATION AND ESTIMATED USAGE FOR COTTON

CHEMICAL	# a.i./A	% USAGE
BASIC COPPER SULFATE	?	?
CAPTAN	.004-.008	50-90
CARBOXIN	.075-.150	50-90
CHLORONEB	.024-.041	20-50
CHLORPYRIFOS	?	<1
DAGGER	?	<1
ETHAZOL	.005-.006	10-30
FENAMINOSULF	?	<5
MANCOZEB	1.0-1.6	<5
MANEB	?	<1
METALAXYL	.0015-.003	30-60
PCNB	1.0-2.1	50-90
THIRAM	.014	50-90

FUNGICIDES, FUNGICIDE FORMULATIONS AND APPLICATION METHODS FOR COTTON

CHEMICAL	APPLICATION METHOD	FORMULATION
BASIC COPPER SULFATE	SEED TREATMENT-NORTH CAROLINA, ?	?
CAPTAN	SEED TREATMENT	FL, WP
CARBOXIN	SEED TREATMENT	FL
CHLORONEB	SEED TREATMENT	WP, FL
CHLORPYRIFOS	SEED TREATMENT	FL, WP
DAGGER	SEED TREATMENT	(BIOLOGICAL CONTROL), G
ETHAZOL	SEED TREATMENT AND IN-FURROW	WP, G
FENAMINOSULF	SEED TREATMENT-NORTH CAROLINA, ?	?
MANCOZEB	FOLIAR SPRAY	WP, FL, DF
MANEB	SEED TREATMENT-NORTH CAROLINA	? ?
METALAXYL	SEED TREATMENT AND IN-FURROW	FL,WP,D,EC,G
PCNB	SEED TREATMENT AND IN-FURROW	FL, WP
THIRAM	SEED TREATMENT	FL, WP

TARGET DISEASES FOR FUNGICIDE TREATMENTS ON COTTON

SEED TREATMENT	FOLIAR TREATMENT
RHIZOCTONIA SEEDLING BLIGHT	RUST
PYTHIUM SEEDLING BLIGHT	ALTERNARIA LEAF SPOT
FUSARIUM SEEDLING BLIGHT	
THIELAVIOPSIS SEEDLING BLIGHT	

PEANUT SUMMARY

Control of diseases and nematodes in peanuts is essential or the crop can not be produced with a profit. During the late 1970's, peanut yields and quality were at their maximum because growers controlled plant diseases and nematodes. With the loss of fumigant nematicides, yields have dropped significantly. If fungicides are removed for use on peanuts, yields could drop an additional 68% and aflatoxin (Seg 3) would increase. Peanuts must be produced with a high level of technology to satisfy both the consumer and the producer.

Essentially, 100% of the peanut seed is treated with a combination of seed treatment fungicides. Without these treatments, stands would be reduced by more than 50% and in some cases no stand would result. Captan is a key ingredient for seed treatment of peanuts. Rhizoctonia spp. are controlled by captan or carboxin. Captan provides control of other soil borne fungi also.

Foliar fungicide spraying for peanuts is essential to control numerous diseases including peanut leafspot and web blotch. Nationally, chlorothalonil is the most widely used foliar fungicide for leafspot and web blotch. Mancozeb is used on less than 5% of the treated acres. Mancozeb, when combined with sulfur, is an effective control for peanut rust which is a common problem in south Texas and a sporadic but severe disease in the southeast U.S. Copper fungicides, benomyl and iprodione are used to some extent. Iprodione is used primarily in the Virginia and Carolina area for control of Sclerotinia-induced diseases. Sulfur is used as a tank mix with other fungicides for additional control of rust. Benomyl was highly effective for control of leafspot until resistance by the pathogens occurred to benomyl in the early to mid 1970's. Benomyl is used for control of other foliar and crown diseases such as crown rot caused by A. niger and aerial blight caused by Rhizoctonia.

Peanut leafspot is related directly to reductions in yield (Extension Plant Pathology Report No. 19 following this summary). Peanut leafspot is most severe in the southeast U.S., but all production areas must spray at least some for this devastating disease. Web blotch is more severe in the southwest production areas of Texas and Oklahoma and must be controlled. Ample resistance to these diseases are not available except for a limited resistance to leafspot in the Southern Runner variety. This variety has not been accepted by the growers or the shellers and its use is limited. Virginia-type varieties are often more susceptible to leafspot and they are grown at an greater frequency because of the larger sized nuts that provide a premium price in the marketplace. Cultural controls such as crop rotation, early planting dates, deep plowing, etc provide some control and are used to reduce the number of sprays. However, these cultural controls are not adequate by themselves to control either foliar or soil borne diseases in peanuts.

Foliar fungicides are applied to peanuts by various methods. Ground

applications are used commonly during the early part of a season before vines become rank. Then, aerial applications are used to a greater extent. Some growers use ground applications exclusively. In the southwest, where irrigation is used commonly because of dry weather, foliar fungicides are injected through irrigation systems.

INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES
UNIVERSITY OF FLORIDA

FLORIDA COOPERATIVE EXTENSION SERVICE

PLANT PROTECTION POINTERS

SS-PLP-801

EXTENSION PLANT PATHOLOGY REPORT NO. 19
GAINESVILLE, FLORIDA APRIL 20, 1976

Tom Kucharek
Extension Plant Pathologist

Gary Sanden
Research Plant Pathologist

PEANUT LEAFSPOT ASSESSMENT AND CONTROL

INTRODUCTION

The peanut leafspot disease caused by fungi, Cercospora spp., causes significant losses in yield. This disease may seem to be severe only during the last few weeks of the peanut season but the final severity is determined by the amount of leafspot early in the season (Figure 1). Growers can now assess their peanut leafspot control program by counting the leafspots and then relating the count to peanut age and yield loss (Figure 1).

METHODS FOR COUNTING

1. Each field is different; therefore counts in each field must be made.

2. Counts made on 9 week old plants are better than those made at a later time because if the counts indicate an average or poor situation it is still time to make some adjustments in your spray program.

3. Collect a total of 50 leaves MIDWAY BETWEEN THE GROUND AND TOP OF THE PLANTS, starting no later than 9 weeks after planting. Each leaf has 4 or sometimes 5 leaflets (Figure 1). Leaves should be collected by placing your hand into the canopy and picking each leaf without looking.

4. The 50 leaves should be collected from various areas of the field and from different rows.

5. Count the total number of leafspots on the leaves. Chemical burns, rust and other leaf blemishes should never be included in the count. Your county agent has pictures and slides of peanut leafspot for you to look at so that you can identify this disease accurately.

This public document was promulgated at an annual cost of $ 52.06, or 4 cents per copy to inform county and state extension on personnel, ranchers and growers of research results in Plant Pathology.

UNDERSTANDING THE GRAPH

1. On Figure 1, move horizontally across the graph from the total number of leafspots you counted until you intersect the age of the peanuts.

2. The final count may be between two of the lines in which case your control program is intermediate to the two surrounding lines.

   EXAMPLE: 1) Data -- you count 60 leafspots on 50 leaves on 9 week old peanuts. Interpretation -- your control program is between a good program and an average program.

   EXAMPLE: 2) Data -- you count 150 leafspots on 50 leaves on 10 week old peanuts. Interpretation -- your control program is poor.

   EXAMPLE: 3) Data -- you count 30 leafspots on 50 leaves on 11 week old peanuts. Interpretation -- keep up your control program; You're doing great!

3. Note that between 9 week old and 11 week old peanuts that the number of leafspots go down on the graph for the average and good lines. Actually, leafspots, once present, do not go away, ever. Instead, the peanut plant has grown more leaves so fast that the probability of collecting leaves with leafspots is temporarily reduced.

4. This graph is based upon data gathered on Florunner peanuts in Florida. The points on the graph with the connecting lines are based on that data.

SUGGESTED CORRECTIVE MEASURES

A. For the remainder of this season.

   1. If control is near average, use shorter intervals between spray applications and use your fungicide at the highest rate per acre as indicated on the label.

   2. If control is poor to average up to the 11th or 12th week, shorten intervals between spray applications to 10 days and use Bravo 6F at 1 1/2 pints/acre or Du-Ter at 8 oz/acre.

   3. If control is poor to average after 12th week, see B below.

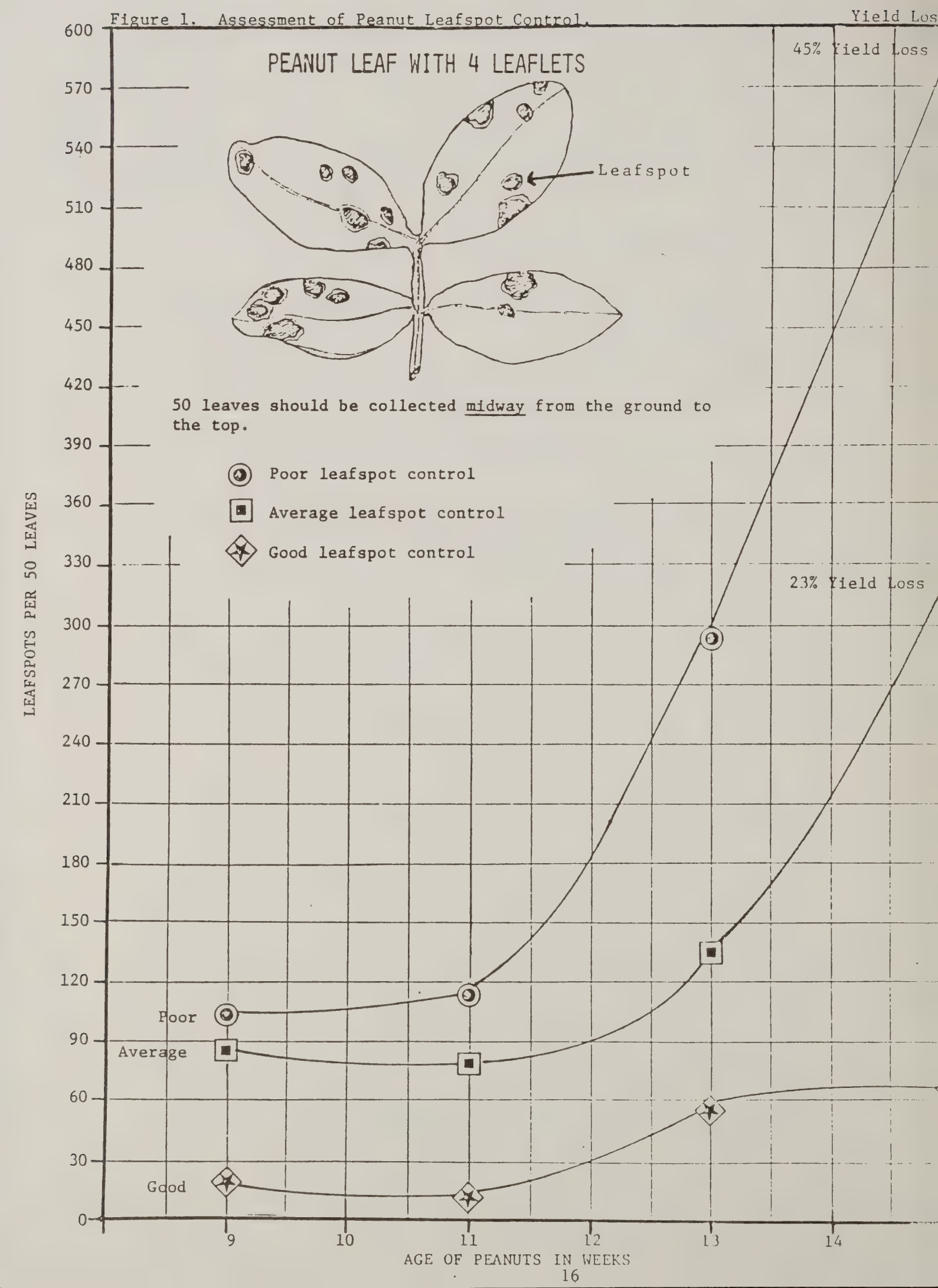
B. For the future.

   1. Crop rotation with previous two years out of peanuts.

   2. Deep plowing.

   3. Start spray program, of at least six fungicide applications per season, no later than 30 days after planting.

Figure 1. Assessment of Peanut Leafspot Control.



ACREAGE OF PEANUTS IN THE U.S.

STATE	PEANUTS
ALABAMA	233,000
ARKANSAS	2,500
FLORIDA	95,000
GEORGIA	690,000
MISSISSIPPI	3,200
NEW MEXICO	13,600
NORTH CAROLINA	155,000
OKLAHOMA	95,000
SOUTH CAROLINA	14,000
TEXAS	260,000
VIRGINIA	92,000

SEED TREATMENTS AND EARLY SEASON SOIL TREATMENTS FOR PEANUTS

STATE	CHEMICAL USED
ALABAMA	DCNA, CAPTAN, CARBOXIN
ARKANSAS	DCNA, CAPTAN, CARBOXIN: PCNB, ETHAZOL (IN-FURROW)
FLORIDA	DCNA, CAPTAN, CARBOXIN
GEORGIA	DCNA, CAPTAN, CARBOXIN
MISSISSIPPI	DCNA, CAPTAN, CARBOXIN
NEW MEXICO	DCNA, CAPTAN, CARBOXIN
NORTH CAROLINA	DCNA, CAPTAN, CARBOXIN
OKLAHOMA	DCNA, CAPTAN, PCNB, METALAXYL, THIRAM, CARBOXIN
SOUTH CAROLINA	DCNA, CAPTAN, CARBOXIN
TEXAS	DCNA, CAPTAN, MANEB, PCNB, ETHAZOL
VIRGINIA	DCNA, CAPTAN, CARBOXIN, THIRAM

MID-SEASON FUNGICIDE APPLICATIONS FOR SOIL BORNE DISEASES IN PEANUTS

STATE	CHEMICAL USED
ALABAMA	PCNB, CHLORPYRIFOS
ARKANSAS	NONE
FLORIDA	CHLORPYRIFOS, METALAXYL
GEORGIA	PCNB
MISSISSIPPI	NONE
NEW MEXICO	PCNB, METALAXYL
NORTH CAROLINA	PCNB, METALAXYL, CHLORPYRIFOS, CARBOXIN,IPRODIONE
OKLAHOMA	PCNB, IPRODIONE, CARBOXIN, METALAXYL
SOUTH CAROLINA	CHLORPYRIFOS, PCNB
TEXAS	PCNB, PROPICONIZOLE
VIRGINIA	IPRODIONE, PCNB, CARBOXIN

FOLIAR FUNGICIDES USED FOR PEANUTS

STATE	CHEMICAL USED
ALABAMA	CHLOROTHALONIL
ARKANSAS	CHLOROTHALONIL, BENOMYL, MANCOZEB, THIOPHANATE- METHYL
FLORIDA	CHLOROTHALONIL, BENOMYL, MANCOZEB, SULFUR, COPPER
GEORGIA	CHLOROTHALONIL, COPPER, SULFUR, MANCOZEB
MISSISSIPPI	CHLOROTHALONIL, BENOMYL
NEW MEXICO	CHLOROTHALONIL, BENOMYL
NORTH CAROLINA	CHLOROTHALONIL, COPPER, BENOMYL, MANCOZEB, SULFUR
OKLAHOMA	CHLOROTHALONIL, BENOMYL, MANCOZEB, THIOPHANATE, COPPER
SOUTH CAROLINA	CHLOROTHALONIL, BENOMYL, MANCOZEB
TEXAS	CHLOROTHALONIL, BENOMYL, MANCOZEB
VIRGINIA	CHLOROTHALONIL, BENOMYL, SULFUR, COPPER

NUMBER OF FUNGICIDE APPLICATIONS USED ON PEANUTS BASED UPON USE PATTERNS

STATE	SEED	FURROW	FOLIAR	SOIL	DIRECT
ALABAMA	1	0	6-7	0-1	
ARKANSAS	1	0-1	3-5	0	
FLORIDA	1	0	3-10	0-1	
GEORGIA	1	0	6	0-1	
MISSISSIPPI	1	0	4-6	0	
NEW MEXICO	1	0	2-3	0-1	
NORTH CAROLINA	1	0-1	2-8	0-2	
OKLAHOMA	1	0	1-6	0-3	
SOUTH CAROLINA	1	0	7-9	0-1	
TEXAS	1	0	2-6	0-2	
VIRGINIA	1	0-1	4	0-4	

PERCENT OF PEANUT ACREAGE RECEIVING SEED & FOLIAR FUNGICIDE TREATMENTS

STATE	% SEED TREATMENT	% FOLIAR TREATMENT
ALABAMA	100%	97%
ARKANSAS	100%	100%
FLORIDA	100%	99%
GEORGIA	100%	100%
MISSISSIPPI	100%	80%-90%
NEW MEXICO	100%	50%
NORTH CAROLINA	100%	100%
OKLAHOMA	100%	100%
SOUTH CAROLINA	100%	100%
TEXAS	100%	90%-95%
VIRGINIA	100%	100%

FUNGICIDE RATES/APPLICATION AND ESTIMATED USAGE FOR PEANUTS

CHEMICAL	# a.i./A	% USAGE
BENOMYL	0.125	<10
CAPTAN	0.114	>80
CARBOXIN	0.068	20-60
CHLOROTHALONIL	0.075-1.125	>80
CHLORPYRIFOS	2.040	<20
COPPER FUNGICIDE	1.12 - 2.31	<10
DCNA	0.050	>80
ETHAZOL	0.0063-0.0125	<10
IPRODIONE	1.000	<5
MANCOZEB	0.8-1.6	<5
MANEB	0.073	<10
METALAXYL	0.500	<5
PCNB	10.00	<20
PROPICONIZOLE	?	<10
SULFUR	1.0-9.0	20-60
THIOPHANATE-METHYL	0.35	<10
THIRAM	0.141	<5

FUNGICIDES, FUNGICIDE FORMULATIONS AND APPLICATION METHODS FOR PEANUTS

CHEMICAL	APPLICATION METHOD	FORMULATION
BENOMYL	FOLIAR SPRAY	WP, DF
CAPTAN	SEED TREATMENT	D, FL
CARBOXIN	SEED AND SOIL TREATMENT	FL, G
CHLOROTHALONIL	FOLIAR SPRAY	FL
CHLORPYRIFOS	SOIL TREATMENT	G
COPPER FUNGICIDE	FOLIAR SPRAY	WP, FL
DCNA	SEED TREATMENT	D, FL
ETHAZOL	SEED TREATMENT	D
IPRODIONE	FOLIAR SPRAY DIRECTED TO SOIL	FL, WP
MANCOZEB	FOLIAR SPRAY	WP, FL
MANEB	SEED TREATMENT	D
METALAXYL	SEED AND SOIL TREATMENT	D, EC, G
PCNB	SEED AND SOIL TREATMENT	FL, D, G
PROPICONIZOLE	FOLIAR SPRAY DIRECTED AT THE SOIL	FL
SULFUR	FOLIAR SPRAY	FL, WP
THIOPHANATE-METHYL	FOLIAR SPRAY	FL, WP
THIRAM	SEED TREATMENT	WP

TARGET DISEASES FOR FUNGICIDE TREATMENTS ON PEANUTS

SEED TREATMENT	FOLIAR TREATMENT
RHIZOCTONIA SEEDLING BLIGHT	ASPERGILLUS CROWN ROT
PYTHIUM SEEDLING BLIGHT	EARLY LEAF SPOT
RHIZOPUS SEED ROT	LATE LEAF SPOT
ASPERGILLUS CROWN ROT	WEB BLOTCH
	RUST
	LIMB & AERIAL BLIGHT
	PEPPER SPOT & LEAF SCORCH
	SOUTHERN STEM ROT (WHITE MOLD)
	SCLEROTINIA BLIGHT

NON-FUNGICIDE MANAGEMENT TECHNIQUES FOR CONTROL OF DISEASES IN PEANUTS

MANAGEMENT TECHNIQUE
CROP ROTATION
SOIL TILLAGE PRIOR TO PLANTING
CORRECT USE OF FERTILIZER AND CALCIUM
WEED CONTROL
NEMATODE CONTROL
PROPER PLANTING DEPTH
RESISTANT VARIETIES
STRESS MINIMIZATION
CROP RESIDUE DESTRUCTION AFTER HARVEST
DISEASE FORECASTING FOR PEANUT LEAF SPOT
PROPER USE OF IRRIGATION

SOYBEAN SUMMARY

The amount of soybean seed treated with a fungicide is variable in the United States and variable in any one area from year to year. Because soybeans are planted usually in warm soil, they emerge fairly rapidly and stand losses from seedling blights are less likely to occur in soybeans compared to crops that are planted in cooler soils. However, entire stands have been destroyed in soybeans. Further, an emerged plant can be infected with Rhizoctonia spp. and not die; such a situation is common and the infected plant yields below its potential. Yield losses of 3 to 7 or more bushels from such a situation have been documented. Seed treatments are used to reduce such a problem. Seed treatments also are used more frequently where plantings are made in cooler soils or soils known to be infested with Phytophthora. Carboxin and chloroneb are used to reduce infections from Rhizoctonia spp. and metalaxyl is being used more frequently for control of Phytophthora. Captan and thiram are used primarily as an all-purpose control by themselves or in combination with the more specific compounds such as carboxin or metalaxyl. Seed treatments are applied by the seed handler or the grower.

Foliar fungicides are used on a small amount of the acreage because the profit margin with soybeans is minimal and the predictability of benefits is uncertain. Some synoptic prediction systems are available in some states. Fields produced in the southeast U.S. or produced for seed are most likely to receive a foliar spray. However, the percentage of sprayed fields are low. Benomyl, TBZ, and thiophanate-methyl are the most common foliar fungicides for soybeans. Chlorothalonil is not used commonly on soybeans because of its higher cost. Yields of soybeans can be increased up to 7 or 8 or more bushels/acre by spraying if the crop is produced in a wet season. Fields produced for seed are sprayed more because of the increased seed quality necessary for certification. Most foliar sprays on soybeans are applied with aircraft. Some directed spraying with high-clearance sprayers is done, but most growers have not invested into this type of equipment that has limited use on a limited acreage.

Crop rotation, proper planting date, proper harvesting date and disease free seed are major control measures for soybean diseases. Resistant varieties are used commonly for certain diseases such as Phytophthora root rot, downy mildew, and frogeye leafspot. However, adequate resistance is not available to many diseases or changes in pathogenic races occur that offset the original resistance. Changes in the pathogen that causes frogeye leafspot is fairly common and breeding programs can not keep pace with the changes in pathogen virulence. The situation is complicated by most soybean varieties being from private sources. With public varieties, the attributes and disadvantages of a given pedigree are known by the public prior to release. With private varieties, the reaction of the pedigree to various diseases is not always known until the crop is produced.

ACREAGE OF SOYBEANS IN THE U.S.

STATE	SOYBEANS
ALABAMA	590,000
ARKANSAS	3,200,000
DELAWARE	260,000
FLORIDA	200,000
GEORGIA	1,100,000
ILLINOIS	9,000,000
INDIANA	4,550,000
IOWA	8,050,000
KANSAS	2,100,000
KENTUCKY	1,100,000
LOUISIANA	2,000,000
MARYLAND	400,000
MICHIGAN	1,000,000
MINNESOTA	5,300,000
MISSISSIPPI	2,200,000
MISSOURI	5,000,000
NEBRASKA	2,750,000
NEW JERSEY	125,000
NEW YORK	50,000
NORTH CAROLINA	1,600,000
NORTH DAKOTA	600,000
OHIO	3,000,000
OKLAHOMA	50,000
PENNSYLVANIA	210,000
SOUTH CAROLINA	800,000
SOUTH DAKOTA	1,760,000
TENNESSEE	1,300,000
TEXAS	240,000
VIRGINIA	525,000
WISCONSIN	400,000

FUNGICIDE SEED TREATMENTS FOR SOYBEANS

STATE	CHEMICAL USED
ALABAMA	CAPTAN, CARBOXIN, THIRAM
ARKANSAS	CAPTAN, CARBOXIN, THIRAM, PCNB, ETHAZOL
DELAWARE	CAPTAN, THIRAM, CARBOXIN
FLORIDA	CAPTAN, CARBOXIN, CHLORONEB
GEORGIA	CAPTAN, CARBOXIN, MANEB
ILLINOIS	CAPTAN, CARBOXIN, TBZ, THIRAM, METALAXYL
INDIANA	METALAXYL
IOWA	METALAXYL (IN-FURROW), CARBOXIN, TBZ
KANSAS	CARBOXIN, CAPTAN, THIRAM, TBZ, PCNB
KENTUCKY	CARBOXIN, THIRAM
LOUISIANA	CARBOXIN, THIRAM, PCNB, ETHAZOL, CAPTAN
MARYLAND	CAPTAN, THIRAM
MICHIGAN	CAPTAN, THIRAM, METALAXYL (IN-FURROW)
MINNESOTA	CARBOXIN, PCNB, METALAXYL (IN-FURROW)
MISSISSIPPI	CAPTAN, CARBOXIN, THIRAM, CHLORONEB, METALAXYL
MISSOURI	CAPTAN, CARBOXIN, TBZ, MANEB
NEBRASKA	CARBOXIN, METALAXYL
NEW JERSEY	CAPTAN, MANEB, THIRAM, METALAXYL
NEW YORK	CAPTAN
NORTH CAROLINA	CARBOXIN, MANEB
NORTH DAKOTA	CARBOXIN, PCNB, METALAXYL
OHIO	CAPTAN, MANEB, THIRAM
OKLAHOMA	CAPTAN, CARBOXIN, CHLORONEB, METALAXYL, PCNB
PENNSYLVANIA	CAPTAN, THIRAM, METALAXYL
SOUTH CAROLINA	CARBOXIN, THIRAM
TENNESSEE	CARBOXIN, THIRAM, TBZ
TEXAS	?
VIRGINIA	CAPTAN, CARBOXIN, THIRAM
WISCONSIN	CARBOXIN, THIRAM, METALAXYL

FOLIAR FUNGICIDES USED ON SOYBEANS

STATE	CHEMICAL USED
ALABAMA	BENOMYL, THIOPHANATE-METHYL, CHLOROTHALONIL
ARKANSAS	BENOMYL, THIOPHANATE-METHYL
DELAWARE	BENOMYL, TBZ
FLORIDA	BENOMYL
GEORGIA	BENOMYL
ILLINOIS	BENOMYL, TBZ, THIOPHANATE-METHYL
INDIANA	BENOMYL, TBZ, THIOPHANATE-METHYL
IOWA	BENOMYL, TBZ
KANSAS	NONE
KENTUCKY	TBZ, THIOPHANATE-METHYL, CHLOROTHALONIL
LOUISIANA	BENOMYL, THIOPHANATE-METHYL
MARYLAND	BENOMYL
MICHIGAN	NONE
MINNESOTA	BENOMYL
MISSISSIPPI	BENOMYL, THIOPHANATE-METHYL
MISSOURI	BENOMYL, TBZ, THIOPHANATE-METHYL, CHLOROTHALONIL
NEBRASKA	NONE
NEW JERSEY	NONE
NEW YORK	CHLOROTHALONIL
NORTH CAROLINA	BENOMYL
NORTH DAKOTA	NONE
OHIO	NONE
OKLAHOMA	BENOMYL, TBZ, THIOPHANATE-METHYL, CHLOROTHALONIL
PENNSYLVANIA	NONE
SOUTH CAROLINA	BENOMYL, TBZ, THIOPHANATE-METHYL, CHLOROTHALONIL
TENNESSEE	BENOMYL, THIOPHANATE-METHYL, TBZ
TEXAS	BENOMYL
VIRGINIA	BENOMYL, CHLOROTHALONIL
WISCONSIN	BENOMYL

PERCENT OF SOYBEAN ACREAGE RECEIVING SEED & FOLIAR FUNGICIDE TREATMENTS

STATE	% SEED TREATMENT	% FOLIAR TREATMENT
ALABAMA	10%	1%-5%
ARKANSAS	60%	10% USED TO BE 20%
DELAWARE	80%	0%
FLORIDA	20%-50%	10%, PRIMARILY SEED PRODUCTION
GEORGIA	5%-30%	<0.5%
ILLINOIS	25%	5% SEED CROP
INDIANA	10%, (5%-15%)	1%
IOWA	15%, IN FURROW <10	<2%-5%, <100 ACRES IN A DRY YEAR
KANSAS	25%	0%
KENTUCKY	15%	2%
LOUISIANA	25%	30% IN 1988, 2% IN 1987
MARYLAND	20%-30%	1%
MICHIGAN	<10%, SOME IN FURROW TRTMT	0%
MINNESOTA	<5%, IN-FURROW <1%	<1%
MISSISSIPPI	50%-60%	7%-10%
MISSOURI	4%	1%, PRIMARILY SEED PRODUCTION
MONTANA	25%	10%
NEBRASKA	5%, IN FURROW <1%	0%
NEW JERSEY	85%	0%
NEW YORK	<5%	<5 SEED PRODUCTION FIELD
NORTH CAROLINA	10%-15%	.1%
NORTH DAKOTA	<5%	0%
OHIO	30%-40% VARIES WITH THE YEAR	0%
OKLAHOMA	25%	0%
PENNSYLVANIA	5%	0%
SOUTH CAROLINA	30%	<1%
TENNESSEE	50%	5%
TEXAS	30%	20% USUALLY WHERE IRRIGATED
VIRGINIA	65%	<1%
WISCONSIN	20% SEED, 4% SOIL	1%

NUMBER OF FUNGICIDE APPLICATIONS ON SOYBEANS BASED UPON USE PATTERNS

STATE	SEED	FURROW	FOLIAR
ALABAMA	0-1	0	0-2
ARKANSAS	0-1	0	0-2
DELAWARE	0-1	0	0-2
FLORIDA	0-1	0	0-2
GEORGIA	0-1	0	0-2
ILLINOIS	0-1	0	0-2
INDIANA	0-1	0	0-1
IOWA	0-1	0-1	0-2
KANSAS	0-1	0	0
KENTUCKY	0-1	0	0-2
LOUISIANA	0-1	0	0-2
MARYLAND	0-1	0	0-1
MICHIGAN	0-1	0-1	0
MINNESOTA	0-1	0-1	0-1
MISSISSIPPI	0-1	0	0-2
MISSOURI	0-1	0	0-2
NEBRASKA	0-1	0-1	0
NEW JERSEY	0-1	0	0
NEW YORK	0-1	0	0-1
NORTH CAROLINA	0-1	0	0-2
NORTH DAKOTA	0-1	0	0
OHIO	0-1	0	0
OKLAHOMA	0-1	0	0-2
PENNSYLVANIA	0-1	0	0
SOUTH CAROLINA	0-1	0	0-2
TENNESSEE	0-1	0	0-2
TEXAS	0-1	0	0-2
VIRGINIA	0-1	0	0-1
WISCONSIN	0-1	0	0-1

FUNGICIDE RATE/APPLICATION AND ESTIMATED USAGE FOR SOYBEANS

CHEMICAL	#a.i./A	% USAGE
BENOMYL	0.250-0.50	<10
CAPTAN	0.028-0.047	5-20
CARBOXIN	0.0156-0.062	5-30
CHLORONEB	0.150	<5
CHLOROTHALONIL	0.75 - 1.875	<1
ETHAZOL	0.013	<1
MANEB	?	<1
METALAXYL	0.009-0.019	<10
PCNB	0.025-0.063	<5
TBZ	0.178-0.297	<5
THIOPHANATE-METHYL	0.350-0.700	<5
THIRAM	0.016-0.062	5-20

FUNGICIDES, FUNGICIDE FORMULATIONS AND APPLICATION METHODS FOR SOYBEANS

CHEMICAL	APPLICATION METHOD	FORMULATION
BENOMYL	>80% AERIAL & <20% GROUND FOLIAR SPRAYS	WP, DF
CAPTAN	SEED TREATMENT	WP, FL
CARBOXIN	SEED TREATMENT	FL
CHLORONEB	SEED TREATMENT	WP, FL
CHLOROTHALONIL	>80% AERIAL & <20% GROUND FOLIAR SPRAYS	FL
ETHAZOL	SEED TREATMENT	WP
MANEB	SEED TREATMENT	FL
METALAXYL	SEED TREATMENT	D, FL, WP, EC
PCNB	SEED TREATMENT	FL, WP
TBZ	>80% AERIAL & <20% GROUND FOLIAR SPRAYS	FL
	SEED TREATMENT	FL
THIOPHANATE-METHYL	>80% AERIAL & <20% GROUND FOLIAR SPRAYS	WP, FL
THIRAM	SEED TREATMENT	FL, WP

TARGET DISEASES FOR FUNGICIDE TREATMENTS ON SOYBEANS

SEED TREATMENT	FOLIAR TREATMENT
RHIZOCTONIA SEEDLING BLIGHT	POD & STEM BLIGHT
PYTHIUM SEEDLING BLIGHT	ANTHRACNOSE
FUSARIUM SEEDLING BLIGHT	FROGEYE LEAF SPOT
PHYTOPHTHORA SEEDLING BLIGHT	BROWN SPOT
ASPERGILLUS SEEDLING BLIGHT	WEB BLIGHT (RHIZOCTONIA)
PENICILLIUM SEEDLING BLIGHT	PURPLE SEED STAIN
SOUTHERN STEM ROT	STEM CANKER
RHIZOPUS SEEDLING BLIGHT	

NON-FUNGICIDE MANAGEMENT TECHNIQUES FOR CONTROL OF DISEASES IN SOYBEANS

MANAGEMENT TECHNIQUE
CROP ROTATION
SOIL TILLAGE PRIOR TO PLANTING
MINIMIZE PLANT STRESS
WEED CONTROL
NEMATODE CONTROL
DISEASE-FREE SEED
PROPER PLANTING DATE
PROPER PLANTING DEPTH
RESISTANT VARIETIES
PROPER HARVESTING DATE
PROPER USE OF IRRIGATION
KNOWLEDGE ABOUT RENTED LAND
USE OF A SYNOMPTIC POINT SYSTEM FOR SPRAYING
WILL HARVESTED CROP BE USED FOR SEED?
CONSIDERATION OF WEATHER VARIABLES
INSECT CONTROL
PLANT IN WELL-DRAINED SOIL

SUGAR BEET SUMMARY

Seed treatments are critical for sugar beet production. Based upon the survey, an array of fungicides is used for seed treatment of sugar beets. Thus, no one compound predominates in the marketplace. Maneb and captan are among the various compounds used for seed treatments. Several fungi, including Rhizoctonia spp., Pythium spp., and Phoma betae can be serious pathogens of sugar beet seedlings. Seed treatments for sugar beet are essential for production as adequate substitutes are not available. Cultural controls such as proper soil tillage, planting depth, and planting date provide some control but by themselves, these control measures will not adequately control seedling blights of sugar beets. Sugar beets are often planted in cool soils as this is a cool weather crop. Cool soils retard emergence and provide a distinct advantage for the fungal pathogens.

Fungicide spraying is necessary in some seasons and situations for the control of Cercospora leafspot and powdery mildew. Applications are made when disease favorable weather occurs. Such applications are usually fewer in number and in fewer years in the northern areas of production. Most applications are made with aircraft because the grower does not need to maintain spray equipment for the few applications required. Fungicide treatments are necessary because foliar diseases reduce sugar content and the crop is sold based upon sugar content in the root. Sulfur is a common foliar fungicide in many states. Mancozeb is used in between 1 and 5% of the sprays. TPTH is one of the more common foliar fungicides. Resistance to benomyl and related compounds occurs in both fungi that cause foliar diseases and therefore the use of benomyl is minimal.

Cultural controls such as earlier planting reduces the need for foliar fungicides and U.S.-developed varieties seem to be more resistant to diseases.

ACREAGE OF SUGAR BEETS IN THE U.S

STATE	SUGAR BEETS
CALIFORNIA	200,000
COLORADO	37,000
IDAHO	160,000
MICHIGAN	152,000
MINNESOTA	480,000
MONTANA	52,000
NEBRASKA	55,000
NORTH DAKOTA	161,000
OHIO	17,000
OREGON	5,000
TEXAS	37,000
WYOMING	53,400

SEED TREATMENT CHEMICALS USED FOR SUGAR BEETS

STATE	CHEMICAL USED
CALIFORNIA	METALAXYL, FENAMINOSULF, PCNB, CHLORONEB
COLORADO	PCNB, THIRAM
IDAHO	METALAXYL, THIRAM
MICHIGAN	THIRAM, FENAMINOSULF, METALAXYL (?FOR FUTURE USE)
MINNESOTA	?
MONTANA	?
NEBRASKA	MANEB
NORTH DAKOTA	MANEB, METALAXYL
OHIO	THIRAM
OREGON	CAPTAN, THIRAM, METALAXYL
TEXAS	THIRAM, METALAXYL, CAPTAN, MANEB, PCNB, CHLORONEB
WYOMING	CAPTAN, THIRAM

FOLIAR FUNGICIDES USED ON SUGAR BEETS

STATE	CHEMICAL USED
CALIFORNIA	TRIADIMEFON
COLORADO	SULFUR
IDAHO	SULFUR, TRIADIMEFON
MICHIGAN	NONE
MINNESOTA	MANCOZEB, TPTH, SULFUR
MONTANA	SULFUR
NEBRASKA	SULFUR, TPTH
NORTH DAKOTA	TPTH
OHIO	TPTH, BENOMYL
OREGON	CHLOROTHALONIL, MANCOZEB, TPTH, SULFUR, TRIADIMEFON
TEXAS	COPPER HYDROXIDE, TRIADIMEFON, SULFUR
WYOMING	TRIADIMEFON, SULFUR, BENOMYL, MANCOZEB, THIOPHANATE

NUMBER OF FUNGICIDE APPLICATIONS ON SUGAR BEETS BASED UPON USE PATTERNS

STATE	SEED	FOLIAR
CALIFORNIA	1	0-3
COLORADO	1	0-2
IDAHO	1	0-3
MICHIGAN	1	0
MINNESOTA	1	0-3
MONTANA	0-1	0-1
NEBRASKA	1	0-1
NORTH DAKOTA	1	0-2
OHIO	1	0-2
OREGON	1	0-3
TEXAS	1	1-5
WYOMING	1	0-2

PERCENT OF SUGAR BEET ACREAGE RECEIVING SEED & FOLIAR FUNGICIDE TREATMENTS

STATE	% SEED TREATMENT	% FOLIAR TREATMENT
CALIFORNIA	100%	80%
COLORADO	100%	20% BUT ONLY IN SOME YEARS
IDAHO	100%	50%-60%
MICHIGAN	100%	0%
MINNESOTA	100%	60% IN 1988 1.7 SPRAYS/ACRE
MONTANA	<15%	0% IN MOST YEARS, 20% IN 1 OUT OF 10 YEARS
NEBRASKA	100%	10%
NORTH DAKOTA	100%	13.5% AVERAGE OF 1.35 APPLICATIONS
OHIO	100%	5%-10%
OREGON	100%	50%
TEXAS	100%	100%
WYOMING	100%	10%

FUNGICIDE RATES/APPLICATION AND ESTIMATED USAGE FOR SUGAR BEETS

CHEMICAL	#a.i./A	% USAGE
BENOMYL	0.188-0.250	<1
CAPTAN	0.028-0.056	<5
CHLORONEB	0.024	<5
CHLOROTHALONIL	?	?
COPPER HYDROXIDE	1.54-3.85	<1
FENAMINOSULF	?	?
MANCOZEB	1.2-1.6	<5
MANEB	?	?
METALAXYL	0.005	20-30
PCNB	0.011-0.023	<1
SULFUR	1.0-12.0	10-40
THIOPHANATE-METHYL	0.263-0.35	<1
THIRAM	NO CALC	50-70
TPTH	0.117-0.293	5-20
TRIADIMEFON	0.250-0.500	5-20

FUNGICIDES, FUNGICIDE FORMULATIONS AND APPLICATION METHODS FOR SUGAR BEETS

CHEMICAL	APPLICATION METHOD	FORMULATION
BENOMYL	FOLIAR SPRAY	WP, DF
CAPTAN	SEED TREATMENT	WP,FL
CHLORONEB	SEED TREATMENT	FL, WP
CHLOROTHALONIL	FOLIAR SPRAY (LABEL NOT FOUND)	?
COPPER HYDROXIDE	FOLIAR SPRAY	WP, FL
FENAMINOSULF	SEED TREATMENT	?
MANCOZEB	FOLIAR SPRAY	WP, FL, DF
MANEB	SEED TRTMT. (LABEL NOT FOUND)	?
METALAXYL	SEED TREATMENT	WP
PCNB	SEED TREATMENT	D
SULFUR	FOLIAR SPRAY	WP, FL
THIOPHANATE-METHYL	FOLIAR SPRAY	WP
THIRAM	SEED TREATMENT	WP, FL
TPTH	FOLIAR SPRAY	FL
TRIADIMEFON	FOLIAR SPRAY	WP, DF

TARGET DISEASES FOR FUNGICIDE TREATMENTS ON SUGAR BEETS

SEED TREATMENT	FOLIAR TREATMENT
RHIZOCTONIA SEEDLING BLIGHT	POWDERY MILDEW
PYTHIUM SEEDLING BLIGHT	CERCOSPORA LEAF SPOT
APHANOMYCES SEEDLING BLIGHT & ROOT ROT	RUST (OREGON ONLY)
PHOMA SEEDLING BLIGHT	
FUSARIUM SEEDLING BLIGHT & ROOT ROT	

NON-FUNGICIDE MANAGEMENT TECHNIQUES FOR CONTROL OF DISEASES IN SUGAR BEETS

MANAGEMENT TECHNIQUE
CROP ROTATION
PROPER PLANTING DEPTH
PROPER PLANTING DATE
MINIMIZE PLANT STRESS
RESISTANT VARIETIES

SUGARCANE SUMMARY

Sugarcane receives less fungicide treatment than any other agronomic crop. The primary controls for sugarcane diseases are cultural controls coupled with resistant varieties. Benomyl or propiconizole are the primary fungicides used for pineapple disease. They are applied as seed piece treatments by dipping seedpiece cane with wire baskets into vats. The only state that uses a significant amount of seed piece treatment is Hawaii. Pineapple disease can cause plant stand losses of 20% or more in Florida. In Hawaii, pineapple disease is quite severe at times as indicated by the entire planted acreage being treated. Replanting is not an adequate control because of competition from established canes that survived from the original planting. Both compounds should remain labelled as both have different modes of action and can therefore be used together on an alternate basis to retard the onset of resistance to the fungal pathogen to either fungicide.

ACREAGE OF SUGARCANE IN THE U.S.

STATE	SUGARCANE
FLORIDA	430,000
HAWAII	181,000
LOUISIANA	300,000
TEXAS	36,000

SEED PIECE CHEMICAL TREATMENTS FOR SUGARCANE

STATE	CHEMICAL USED
FLORIDA	PROPICONIZOLE
HAWAII	PROPICONIZOLE, BENOMYL (WITH HOT OR COLD WATER)
LOUISIANA	NONE
TEXAS	BENOMYL, HOT WATER

FOLIAR FUNGICIDES USED FOR SUGARCANE

STATE	CHEMICAL USED
FLORIDA	NONE
HAWAII	NONE
LOUISIANA	NONE
TEXAS	NONE

NUMBER OF FUNGICIDE APPLICATIONS ON SUGARCANE BASED UPON USE PATTERNS

STATE	SEEDPIECE	FOLIAR
FLORIDA	0-1	0
HAWAII	1	0
LOUISIANA	0-1	0
TEXAS	0-1	0

PERCENT OF SUGARCANE ACREAGE RECEIVING SEED & FOLIAR FUNGICIDE TREATMENTS

STATE	% SEED TREATMENT	% FOLIAR TREATMENT
FLORIDA	5%	0%
HAWAII	100%	0%
LOUISIANA	0%-1%	0%
TEXAS	<5%	0%

FUNGICIDE RATES/APPLICATION AND ESTIMATED USAGE FOR SUGARCANE

CHEMICAL	RATE	% USAGE
BENOMYL	0.125-0.250	10
PROPICONIZOLE	0.021	10

FUNGICIDES, FUNGICIDE FORMULATIONS AND APPLICATION METHODS FOR SUGARCANE

CHEMICAL	APPLICATION METHOD	FORMULATION
BENOMYL	SEED PIECE TREATMENT	WP, DF
PROPICONIZOLE	SEED PIECE TREATMENT	FL
WATER (COLD OR HOT)	SEED PIECE TREATMENT	LIQUID

TARGET DISEASES FOR FUNGICIDE TREATMENTS ON SUGARCANE

SEED TREATMENT	FOLIAR TREATMENT
PINEAPPLE DISEASE	

NON-FUNGICIDE MANAGEMENT TECHNIQUES FOR CONTROL OF DISEASES IN SUGARCANE

MANAGEMENT TECHNIQUE
USE OF AT LEAST THREE NODES IN CUTTING
PLANT WHEN SOIL MOISTURE AND TEMPERATURE ARE FAVORABLE
RESISTANT VARIETIES
USE HEALTHY CUTTINGS

TOBACCO SUMMARY

Tobacco seed is not treated with fungicides because of their small size and sensitivity. Further, just about all tobacco is planted from seed initially into fumigated plant beds or sanitized greenhouse production systems.

Two major foliar diseases of tobacco in the United States are controlled by foliar fungicide treatments. Blue mold can be a serious problem in any year, particularly if excessive rainfall occurs as it did in 1979, 1980, 1983, and 1988. In 1979, blue mold caused crop value losses of more than $250,000,000 in the United States and Canada. This high value loss was with only 9.4% yield loss of the crop.

Blue mold can be reduced by some cultural practices such as avoidance of excessive irrigation, avoidance of excessive nitrogen fertilizer, and use of plastic plant bed covers. However, these controls provide only a small amount of control in highly disease favorable weather. Resistant varieties for blue mold are not available. Anthracnose is a major disease of tobacco in the plant bed in the northern areas of tobacco production in the United States. Avoidance of producing an unthrifty plant is about the only cultural control available. However, a more thrifty plant is more susceptible to blue mold.

Metalaxyl is the primary chemical control for blue mold. Resistance to metalaxyl within the blue mold pathogen exists in Mexico and Texas. Should this resistance appear in the major tobacco-growing regions of the United States and Canada a catastrophic situation could exist. Ferbam is the only other fungicide currently labelled for control of blue mold and its availability is minimal. The voluntary withdrawal of maneb and mancozeb for use on tobacco from labels over the past several years has created a serious situation if resistance to metalaxyl occurs. Further, mancozeb was relied upon for control of anthracnose in the northern areas of tobacco production in the United States.

Nearly all fungicide sprays on tobacco are made as directed sprays to the crop in the plant bed or at a young plant stage in the field. Residues at harvest from such use patterns are expected to be minimal in the crop. Also, directed sprays reduce any adverse effects to the environment. Because the primary use of mancozeb was for the plant bed, a very small area of land is involved because 100 sq yd of bed is needed for 3 acres of field planting. The importance of mancozeb for tobacco production in terms of reducing the onset of resistance to metalaxyl by the blue mold pathogen and providing control of anthracnose can not be over emphasized. Resistance is not available for either pathogen in any varieties.

Any reliance on ferbam will increase the number of sprays from a few/season to a few/week. Applicator exposure will increase and disease control will be inadequate. The voluntary withdrawals of maneb and

mancozeb for use on tobacco has created a serious and unnecessary situation for tobacco producers. The use of mancozeb on tobacco should be reinstated as mancozeb was the best alternative for preventing resistance to metalaxyl.

ACREAGE OF TOBACCO IN THE U.S.

STATE	TOBACCO
ALABAMA	150
CONNECTICUT & MASSACHUSETTS	2,000
FLORIDA	7,000
GEORGIA	35,000
INDIANA	30
KANSAS	?<30
KENTUCKY	160,000
LOUISIANA	<300
MARYLAND	10,000
MINNESOTA	??????
MISSOURI	1,800
NORTH CAROLINA	268,000
OHIO	8,000
PENNSYLVANIA	12,000
SOUTH CAROLINA	50,000
TENNESSEE	49,440
VIRGINIA	41,730
WEST VIRGINIA	1,900
WISCONSIN	6,000

FUNGICIDES USED IN TRANSPLANT BEDS ON TOBACCO

STATE	CHEMICAL USED
ALABAMA	METALAXYL, MANEB, MANCOZEB
CONN. & MASS.	METALAXYL
FLORIDA	METALAXYL, MANEB, MANCOZEB
GEORGIA	METALAXYL, MANEB, MANCOZEB
INDIANA	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, MANCOZEB, METIRAM,ZINEB
KANSAS	?
KENTUCKY	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, MANCOZEB, ZINEB, METIRAM
LOUISIANA	NONE
MARYLAND	METALAXYL, MANCOZEB
MINNESOTA	?
MISSOURI	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, MANCOZEB, ZINEB, METIRAM
NORTH CAROLINA	METALAXYL, MANEB, MANCOZEB,FERBAM, STREPTOMYCIN SULFATE
OHIO	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, ZINEB, METIRAM, MANCOZEB
PENNSYLVANIA	METALAXYL
SOUTH CAROLINA	METALAXYL
TENNESSEE	METALAXYL, MANCOZEB, STREPTOMYCIN SULFATE
VIRGINIA	METALAXYL, FERBAM, BORDEAUX MIXTURE, MANEB, MANCOZEB, METIRAM, ZINEB
WEST VIRGINIA	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, ZINEB, METIRAM, MANCOZEB
WISCONSIN	METALAXYL, ZINEB

FUNGICIDES USED IN THE FIELD FOR TOBACCO

STATE	CHEMICAL USED
ALABAMA	METALAXYL, MANEB, MANCOZEB
CONN. & MASS.	METALAXYL
FLORIDA	METALAXYL, MANEB, MANCOZEB
GEORGIA	METALAXYL, MANEB, MANCOZEB
INDIANA	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, ZINEB, MANCOZEB, METIRAM
KANSAS	?
KENTUCKY	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, ZINEB, MANCOZEB, METIRAM
LOUISIANA	NONE
MARYLAND	MANCOZEB
MINNESOTA	?
MISSOURI	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, ZINEB, MANCOZEB, METIRAM
NORTH CAROLINA	METALAXYL, ZINEB, FERBAM
OHIO	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, ZINEB, METIRAM, MANCOZEB
PENNSYLVANIA	MANCOZEB
SOUTH CAROLINA	METALAXYL
TENNESSEE	METALAXYL, MANCOZEB, STREPTOMYCIN SULFATE
VIRGINIA	METALAXYL, FERBAM, MANEB, MANCOZEB, ZINEB
WEST VIRGINIA	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, ZINEB, METIRAM, MANCOZEB
WISCONSIN	BASIC COPPER SULFATE, STREPTOMYCIN SULFATE

NUMBER OF FUNGICIDE APPLICATIONS FOR TOBACCO BASED UPON USE PATTERNS

STATE	PLANT BED	FIELD
ALABAMA	0-2	0-2
CONN. & MASS.	0-1	0-1
FLORIDA	0-2	0-2
GEORGIA	0-1	0-2
INDIANA	0-3	0-2
KANSAS	?	?
KENTUCKY	0-3	0-2
LOUISIANA	0	0
MARYLAND	0-4	0-4
MINNESOTA	?	?
MISSOURI	0-3	0-2
NORTH CAROLINA	0-2	0-1
OHIO	0-3	0-2
PENNSYLVANIA	0-2	0-2
SOUTH CAROLINA	0-1	0-2
TENNESSEE	0-4	0-3
VIRGINIA	0-7	0-2
WEST VIRGINIA	0-3	0-2
WISCONSIN	0-1	0-3

PERCENT OF TOBACCO ACREAGE RECEIVING SEED & FOLIAR FUNGICIDE TREATMENTS

STATE	% SEED	% PLANT BEDS[1]	% FIELD[1]
ALABAMA	0%	80%-90%	50%-70%
CONN. & MASS.	0%	90%	90%
FLORIDA	0%	80%-90%	50%-70%
GEORGIA	0%	80%-90%	50%-70%
INDIANA	0%	85%	40%-65%
KANSAS	0%	0%	0%
KENTUCKY	0%	85%	40%-65%
LOUISIANA	0%	0%	0%
MARYLAND	0%	50%	25%
MINNESOTA	0%	?	?
MISSOURI	0%	85%	40%-65
NORTH CAROLINA	0%	80%-90%	75%
OHIO	0%	85%	40%-65%
PENNSYLVANIA	0%	60%	10%
SOUTH CAROLINA	0%	70%	70%
TENNESSEE	0%	55%	50%-60%
VIRGINIA	0%	95%	80%
WEST VIRGINIA	0%	85%	40-65%
WISCONSIN	0%	33%	15%

[1]Includes preplant soil treatments with metalaxyl

FUNGICIDE RATES/APPLICATION AND ESTIMATED USAGE FOR TOBACCO

CHEMICAL	#a.i./A	% USAGE BED	% USAGE FIELD
BORDEAUX MIXTURE	?	<1	<1
FERBAM	1.5-2.3	<5	<1
MANCOZEB	0.8-1.3	5-20	<1
MANEB	1.8-3.2	<5	<1
METALAXYL	.25-3.0	70-90	70-90
METIRAM	1.6	<1	<1
STREPTOMYCIN-SULFATE	100-200 ppm	5-10	<1
ZINEB	1.5	<5	<1

FUNGICIDES, FUNGICIDE FORMULATIONS AND APPLICATION METHODS FOR TOBACCO

CHEMICAL	APPLICATION METHOD	FORMULATION
BORDEAUX MIXTURE	FOLIAR SPRAY IN PLANT BED	IDENTITY?
FERBAM	FOLIAR SPRAY IN PLANT BED AND FIELD	WDG
MANCOZEB, (LABEL LOST)	FOLIAR SPRAY IN PLANT BED AND FIELD	WP, FL
MANEB, (LABEL LOST)	FOLIAR SPRAY IN PLANT BED AND FIELD	WP,FL
METALAXYL	SOIL APPLICATION IN PLANT BED AND FIELD	EC
METIRAM, (LABEL LOST)	FOLIAR SPRAY IN PLANT BED	WP
STREPTOMYCIN SULFATE	FOLIAR SPRAY IN PLANT BED AND FIELD	SP
ZINEB, (LABEL LOST)	FOLIAR SPRAY IN PLANT BED AND FIELD	WP

TARGET DISEASES FOR FUNGICIDE TREATMENTS ON TOBACCO

PLANT BED	FIELD
BLUE MOLD	BLUE MOLD
BLACK SHANK	BLACK SHANK
PYTHIUM ROOT ROT	PYTHIUM ROOT ROT
WILDFIRE	WILDFIRE
ANTHRACNOSE	

NON-FUNGICIDE MANAGEMENT TECHNIQUES FOR CONTROL OF DISEASES IN TOBACCO

PLANT BED	FIELD
CROP ROTATION	CROP ROTATION
RESISTANT VARIETIES	RESISTANT VARIETIES
SOIL TILLAGE PRIOR TO PLANTING	SOIL TILLAGE PRIOR TO PLANTING
SOIL FUMIGATION	NEMATODE CONTROL
SANITATION	SANITATION
CORRECT FERTILIZER USAGE	CORRECT FERTILIZER USAGE
	CORRECT HARVESTING TACTICS
	DESTROY OLD CROP RESIDUE AFTER HARVEST

FUNGICIDES USED IN TRANSPLANT BEDS ON TOBACCO

STATE	CHEMICAL USED
ALABAMA	METALAXYL
CONN. & MISS.	METALAXYL
FLORIDA	METALAXYL
GEORGIA	METALAXYL
INDIANA	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, MANCOZEB, METIRAM, ZINEB
KANSAS	?
KENTUCKY	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, MANCOZEB, ZINEB, METIRAM
LOUISIANA	NONE
MARYLAND	METALAXYL, MANCOZEB
MINNESOTA	?
MISSOURI	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, MANCOZEB, ZINEB, METIRAM
NORTH CAROLINA	METALAXYL, MANEB, MANCOZEB, FERBAM, STREPTOMYCIN SULFATE
OHIO	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, ZINEB, METIRAM, MANCOZEB
PENNSYLVANIA	METALAXYL
SOUTH CAROLINA	METALAXYL
TENNESSEE	METALAXYL, MANCOZEB, STREPTOMYCIN SULFATE
VIRGINIA	METALAXYL, FERBAM, BORDEAUX MIXTURE, MANEB, MANCOZEB, METIRAM, ZINEB
WEST VIRGINIA	METALAXYL, STREPTOMYCIN SULFATE, FERBAM, MANEB, ZINEB, METIRAM, MANCOZEB
WISCONSIN	METALAXYL, ZINEB